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*Numerical studies of the dynamics of excitation and ionization*

Atoms in strong, short pulse optical laser fields exhibit several manifestations of non-perturbative behavior. The ionization dynamics is mediated by excitation of ac Stark shifted excited states up to intensities at which the laser can cause a valence electron to be field ionized. This becomes possible the oscillating electric field distorts the binding potential enough to allow the electron to tunnel free. This evolution in the ionization dynamics is reflected in the photon and electron emission spectra. Numerical solutions of the time-dependent Schrödinger equation using a single-active-electron approximation provide a picture of the dynamical processes involved. The time-dependent wave function shows the change from multiphoton, resonance dominated ionization to tunneling as the laser intensity is increased. The final state distributions are quite sensitive to the pulse shape since the neutral atom can survive to higher intensities when the pulse width decreases. This work was carried out in part under the auspices of the US Department of Energy at the Lawrence Livermore National Laboratory Contract No. W-7405-ENG-48 and in collaboration with K. J. Schafer from LSU.